DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name:	Sunoco - Frankford Facility
Facility Address:	Margaret and Bermuda Streets, Philadelphia, PA 19137
Facility EPA ID #:	PAD 002 312 791

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   X If yes - check here and continue with #2 below.

   ____ If no - re-evaluate existing data, or

   ____ if data are not available skip to #6 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

As documented in the Phase I and Phase II RCRA Facility Investigation (RFI) Reports, both NAPL and dissolved phase chemicals were identified in groundwater. Analytical samples of NAPL and groundwater collected from the site contain Volatile Organic Compound (VOCs), Semi-Volatile Organic Compounds (SVOCs), and metals.

The following chemicals compounds were detected during the Phase I and Phase II RFI investigation:

VOCs	SVOCs	Metals
1,1,1-Trichloroethane	Acenaphthene	Aluminum
Acetone	Acenapthylene	Arsenic
Benzene	Anthracene	Barium
Benzoic Acid	Carbazole	Cadmium
2-Butanone	Dibenzofuran	Calcium
Chlorobenzene	2,4-Dimethylphenol	Chromium
Chloroethane	bis-(2-Ethylhexyl)	Iron
Bis(2-cloroethyl)ether	phthalate	Lead
Chloroform	Flouranthene	Magnesium
Cumene	Fluorene	Manganese
Total 1,2-DCE	2-Methylphenol	Mercury
Ethylbenzene	4-Methylphenol	Nickel
Hexachloroethane	Naphthalene	Potassium
2-Hexanone	Phenanthrene	Selenium
Methylene Chloride	Pyrene	Sodium
2-Methylnaphthalene		Vanadium
4-Methyl-2-Pentanone		Zinc
Methyl Styrene		
Phenol		
Pyridine		
Styrene		
Toluene		
Xylene		

[1]"Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

Additional groundwater monitoring well sampling was conducted in June 1996, December 1998, August 2000, September 2001, December 2003, and June 2004. The groundwater constituent concentrations for these events are summarized in Tables A-1 through A-3, contained in reference 1.

Dense Non-Aqueous Phase Liquid (DNAPL) has been intermittently observed in monitoring wells in the southwest portion of the plant. Currently DNAPL is present in one well, MW-302.

Due to the presence of Light Non-Aqueous Phase Liquid (LNAPL) in the subsurface beneath the central portion of the facility, RCRA Interim Measures were authorized by the EPA in October 1993 to recover LNAPL. The active LNAPL pumping system was installed in April 1994 with additions to the system added in subsequent months. In December 2000, an LNAPL recovery trench was installed in 3 segments along 4th Street north of the boiler house. Continuous pumping from this system begab in July 2001. In accordance with EPA permit, semi-annual reporting on the LNAPL recovery system performance is required. (See January- June 2004 Semi-Annual Report: LNAPL Recovery Systems Oversight Activities; NTH Consultants; July 2004.)

See Reference 2 for the approximate extent of the NAPLs at the site as observed in June 2004.

Reference 1 - Groundwater Analytical Data Summary Tables, Documentation of Environmental Indicator Determination, Sunoco Chemicals Frankford Plant Philadelphia, PA September 2004

Reference 2 - Figure 1, Sunoco Chemicals Frankford Plant Philadelphia, PA September 2004

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Results of a comparison of EPA Region III RBCs and PA ACT II Used Aquifer criteria to the historical concentrations of chemicals in Site boundary wells is presented in Figure 1 of Reference 2 (see Section 2 above).

Figure 1 (Reference 2) illustrates that concentrations at the site boundary are below the PA Used Aquifer Criteria and are stable in both shallow (pink line - Figure 1) and deep groundwater zones (green line - Figure 1).

Some fluctuation in dissolved concentrations is occurring along the western boundary at wells MW-110 and MW-122, but investigations performed to date indicate that dissolved phase constituents are bounded on the north and west (M04, M10, and MW-121) and the fluctuations are localized occurrences that do not represent an overall trend in plume concentrations.

Additionally, results of historical monitoring of the LNAPL plume indicate that the LNAPL source is stable at the northern periphery and decreasing substantially in the southern area due to active recovery efforts being performed at the plant.

Results following the installation of a grout barrier indicate that infiltration of impacted groundwater to the sewer system has been significantly reduced and results from the Semi-Annual Wastewater Discharge monitoring are in compliance with the facility permit inspections of the sewer system as part of the wastewater discharge permit for the Phialdelphia POTW including integrity checks and sample analytical data.

Groundwater monitoring data from Well MW-112 indicate that sewer backfill does not form an off0site migration pathway along the western property boundary on Leferve Street.

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

_X_ If yes - continue after identifying potentially affected surface water bodies.

____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Based on results of the tidal studies of the Frankford Inlet and its interaction with site groundwater, mean hydraulic gradients towards the inlet have been calculated. Tidal studies indicate that there is little, if any, discharge of shallow groundwater to surface water as evidenced by lack of tidal effects in MW-107 and MW-104. Tidal studies confirmed that deep groundwater may contribute to surface water near Frankford Inlet as evidenced by tidal response in MW-301 and MW-306.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?.

   X If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

   ____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

   ____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

The maximum deep groundwater concentrations near surface water do not exceed the PA Used Aquifer, residential MSCs by more than ten times. Therefore, concentrations of any dissolved constituents discharging to surface water will also be less than ten times the applicable groundwater criteria.

Modeled shallow groundwater contributions at the Frankford Inlet indicate that all constituents are below:

1. Delaware River Basin Commission (DRBC) stream quality objectives applied for human health in zones 2 and 3, for carcinogens, and for systemic toxicants for the Delaware River Estuary (Administrative Manual Part III, Water Quality Regulations, updated October 23, 1996, Tables 3, 5, 6 in Article 3).

2. Pennsylvania Code, Chapter 16 Water Quality Toxics Management Strategy - Statement of Policy, Table 1, Water Quality Criteria for Toxic Substances, Lower Value of Either "fish and Aquatic Life Criteria" or "Human Health Criteria" (November 18, 2000).

Modeling was performed using the highest dissolved groundwater concentrations observed near surface water (MW-107). A comparsion of groundwater concentrations, modeled concentrations and applicable criteria are shown on Table B-1 in Reference 3. SWLOAD worksheets for these calcualations are also provided in Reference 3.

Reference 3 - Groundwater and Surface Water Interaction Data and Graphs, Documentation of Environmental Indicator Determination, Sunoco Frankford Plant Philadelphia, PA September 2004.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently**

acceptable" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as

necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

_X_ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

____ If no - enter "NO" status code in #8.

____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Panning for a long term monitoring workplan is currently being completed. In general, it is planned to monitor as follows:

1. Annual monitoring of seventeen existing boundary wells and three select interior wells.

2. Additional semi-annual monitoring of wells MW-110, MW-112, MW-118, MW-121 and MW-122.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

_X_ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Sunoco Chemicals Frankford Plant Philadelphia, PA facility , EPA ID # PAD 002 312 791 , located at Margaret and Bermuda Streets, Philadelphia, PA 19137. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

____ IN - More information is needed to make a determination.

Completed by (signature) /s/ Date 9-29-04
(print) Hon Lee
(title) Remedial Project Manager

Supervisor (signature) /s/ Date 9-29-04
(print) Paul Gotthold
(title) Chief, PA Operations Branch
(EPA Region or State) EPA region III

Locations where References may be found:

US EPA Region III, Waste and Chemicals Management Division, 3WC22, 1650 Arch Street, Philadelphia, Pa 19103.

Additional References:
A. Phase I RCRA Facility Investigation Report
B. Phase II RCRA Facility Investigation Report
C. June 1996 Groundwater Sampling Results Letter Report
D. August 2000 Groundwater Sampling Results Letter Report
E. January 2002 Groundwater Sampling Results Letter Report
F. January - June 2004 Semi-Annual Report: LNAPL Recovery Systems Oversight Activities
G. Final Report: Conceptual Design Study for Free-Phase Product Recover

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